Association Between Somali Mothers' Oral Health Literacy and Their Children's Caries Experience in Minnesota

A THESIS SUBMITTED TO THE FACULTY

OF THE DIVISION OF DENTAL HYGIENE SCHOOL OF DENTISTRY

UNIVERSITY OF MINNESOTA

BY

Kylee Elaine Zeyer

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MASTER OF SCIENCE IN DENTAL HYGIENE

Dr. Priscilla Flynn

July 2019

ACKNOWLEDGMENTS

I would like to thank Dr. Priscilla Flynn for your support and guidance in completing my thesis. I appreciate your endless efforts, as well as, the knowledge and wisdom you provided me throughout this process.

DEDICATION

This thesis is dedicated to my daughter, Laylani, to serve as a reminder that dreams and success can be achieved through hard work, determination, and faith in oneself. As well as, in loving memory of Mickey Weagant, for making it all possible.

Table of Contents

List of Tables:

SECTION ONE

INTRODUCTION

Dental caries, also known as tooth decay, is the most common preventable chronic infectious disease affecting children worldwide (1-11). The cause of dental caries is multifactorial, which means there are numerous contributing factors that affect an individual's risk for tooth decay. These factors include personal oral home care habits, diet, access to dental care, fluoride exposure, socioeconomic status, utilization of preventive dental services, early transmission of cariogenic bacteria from parent or caregiver to child, and oral health attitudes, beliefs, and knowledge (1-6,10-20). Globally, the caries burden is higher among children of immigrants, ethnic minorities, and lower socioeconomic status, and these populations are also less likely to utilize or have access to dental care (2-7,9-17). Although, multiple factors may contribute to childhood caries in these populations, oral health literacy is suggested to be a stronger predictor of an individual's oral health status than age, socioeconomic status, and ethnic or racial group (2,3,6,13,15,21). While, the literature suggests parental or caregiver oral health literacy could be related to children's caries experience; the number of studies investigating this relationship among mother-child dyads are limited (6,7,17,20).

Oral health literacy is defined as "the degree to which individuals have the capacity to obtain, process, and understand basic oral and craniofacial health information and services needed to make appropriate health decisions" (7). Oral health literacy is a subset of health literacy, and research supports that health knowledge, attitudes, practices, and utilization of health services are influenced by an individual's level of health literacy (7). Caries experience is the extent to which an individual has had tooth decay in either their primary or permanent dentition, and is often determined by the number of decayed,

missing, and filled teeth or surfaces (dmft/DMFT or dmfs/DMFS) (6-9,11-13,15,17,18,20,25). The dmft/dmfs indices represent primary dentition and DMFT/DMFS indices represent permanent dentition (25). Several studies have evaluated the potential relationship between mothers' oral health literacy and their children's caries experience, and the results revealed that low oral health literacy of mothers was significantly related to higher caries experience in the children (6,7,17,20).

Brega et al. conducted a study that evaluated parental oral health knowledge as it relates to children's oral health status (6). The majority of the parents in the study were mothers, and the findings indicated that parents with lower health literacy scores reported poorer oral health status for themselves and rated their children's oral health-related quality of life as poor (6). However, Brega et al., did not find a significant relationship between parental health literacy and the children's dmfs scores (6). In contrast, Haghdoost et al. investigated the caries experience of children in Iran and the mothers' health literacy on childhood caries (20). The results revealed that the probability of decayed teeth in children of illiterate mothers was 17% higher than from literate mothers (20). In Hong Kong, Fong Lai et al. evaluated parental oral health literacy in relation to their children's caries experience, which consisted of 242 mothers and 69 fathers (7). The study found that the majority of participating children had untreated dental caries; while, over 70% of the parents had only up to a secondary education, scored low on the pediatric oral health literacy questionnaire, and were of lower socioeconomic status (7). Existing research supports the relationship between parental oral health literacy and their children's caries experience; however, few studies have evaluated this relationship among Somali immigrant or refugee populations in the United States (17).

Over the past decade, the Somali population has been one of the fastest growing immigrant populations in the U.S., and the Minneapolis and St. Paul areas in Minnesota is home to one of the largest Somali communities in the nation (12-14,16,17,19). However, little knowledge exists regarding this population's caries experience and oral health literacy. In Massachusetts, Hunter-Adams and Geltman et al. found that Somali adult refugees with higher oral health literacy were more likely to utilize dental services and have less untreated tooth decay (19). This association was significantly related to the increased acculturation or adoption of modern U.S. customs among the participants (19). Conversely, another study by Geltman et al. found that lower health literacy scores of Somali subjects living in the U.S. for 0-4 years correlated with lower caries experience; whereas, Somalis living in the U.S. for 5-10 years correlated with higher caries experience (12). The results indicated that increased acculturation was significantly associated with increased caries experience among Somali adults (12).

In contrast, Svensson et al. conducted a study in Sweden to gather baseline information on newly arrived Somali families, which included the caries experience of the children and the oral health knowledge of the parents (4). The results indicated that a high proportion of children of all ages were affected by oral disease and in need of urgent dental care, and over half the parents responded incorrectly or I don't know on the oral health knowledge surveys (4). Although, Somali communities are expanding in Minnesota; little knowledge exists regarding oral health literacy and caries experience of Somali mother-child dyads (17). Therefore, the purpose of this study was to evaluate the association between Somali mothers' oral health literacy and their children's caries experience residing in the Minneapolis and St. Paul areas in Minnesota.

Purpose of the Study

The purpose of this study was to evaluate the association between the oral health literacy level and caries experience of Somali mother-child dyads residing in the Minneapolis and St. Paul areas in Minnesota.

Statement of the Problem

Dental caries affects children of all ages, races, and socioeconomic status and has been linked to poor diet, suboptimal fluoride exposure, inadequate oral self-care, and lack of utilization and access to dental care (1-6,10-17,20). The oral health mission of the U.S. Office of Disease Prevention and Health Promotion and Healthy People 2020 is to prevent and control oral and craniofacial diseases and to improve access to dental care for those living in the U.S. (21,22). To accomplish this for children living in the U.S., a series of oral health objectives were developed that focused on reducing dental caries, improving oral health, and increasing access to care for U.S. children (21,22). Despite these efforts, immigrant and minority children in the U.S. continue to suffer from dental caries and low access to dental care (21,22). Current demographic statistics revealed Somali immigrants are among one of the fastest growing immigrant populations in the U.S., particularly in Minnesota; yet, little knowledge exists regarding the oral health of this population (12-14,16,17,19).

As a result, further research efforts are required to gain knowledge regarding the oral health of this population, which could aid in reducing dental caries and improving access to dental care for Somali-American children living in the U.S. Existing research has found significant associations between oral health literacy and caries experience of individuals in various populations around the world, but many did not target mother-child

dyads (2,3,6-8,12,13,15,18-20). Although, the number of existing oral health studies targeting mother-child dyads are limited, several studies have found significant relationships between parental oral health literacy and children's oral health status (6,7,17,20). Existing research supports that individuals with lower oral health literacy are less likely to utilize oral health care services, thus leading to increased cases of untreated tooth decay (2,6,12,13,15,17,19). However, many of these studies were limited to adults and caregivers and did not include Somali mother-child dyads (2,6,12,13,15,19).

In spite of this, further research is needed to investigate the association between Somali mothers' oral health literacy and children's caries experience to serve this population more effectively and efficiently. Without this research, existing information pertaining to the oral health literacy and caries experience of Somali mother-child dyads residing in Minnesota would be minimal. Thus, limiting the oral health knowledge and support necessary to determine the need for oral health education, promotion, and dental services among Somali-American communities.

Significance of the Study

This study will provide valuable information pertaining to the current oral health literacy and caries experience of Somali mother-child dyads residing in the Minneapolis and St. Paul areas in Minnesota. It will enable researchers to statistically evaluate various associations between these factors, which could provide significant information that could help address oral health literacy, oral health status, and access to care for the Somali-American population in Minnesota. Existing oral health studies on the Somali population are limited; therefore, all information gathered from this study will be beneficial and provided insight to this population's oral health literacy, acculturation

status, oral health status, and caries experience.

Research Question

What is the association between Somali mothers' oral health literacy level and their children's caries experience in the Minneapolis and St. Paul areas in Minnesota?

Null Hypothesis

The oral health literacy of Somali mothers residing in the Minneapolis and St. Paul areas in Minnesota is not inversely associated with their children's caries experience.

SECTION TWO

REVIEW OF THE RELATED LITERATURE

In the United States, immigrant and refugee communities continue to grow, but existing research regarding their oral health literacy (3,17,19), acculturation status (12-14,17,19), oral health status (3,12,14,16,17,19) and caries experience (12,13,16,17,19) is limited. Minnesota is home to one of the largest Somali communities in the U.S, but little knowledge exists regarding oral health literacy and caries experience among Somali immigrant mother-child dyads (16,17). Childhood caries is a major oral health concern that affects children worldwide; however, few studies exist regarding the caries experience of Somali children living in the U.S. (17). To gain an understanding of the oral health literacy and caries experience of Somalis or similar immigrant populations, an extensive search was conducted in PubMed, MNCAT, and Ovid databases. A series of MeSH terms in various configurations were used in the search, including oral health literacy, childhood caries, children's oral health, Somali, refugee oral health, and caries experience. A total of 52 articles were reviewed, and articles not related to Somali or immigrant oral health literacy, caries experience, or children's oral health were excluded, which produced 23 relevant articles.

Upon review of the literature, it was clear that immigrants and refugees were more likely to have poorer oral health status and greater caries experience compared to native-born counterparts (3-5,10,12-14,17,19). A study conducted by Reza et al. evaluated the oral health status of immigrant and refugee children in North America (5). The results indicated that immigrant or refugee children had significantly greater caries experience and a greater number of untreated carious lesions compared to native-born children (5). Existing studies have evaluated relationships between oral health status (1,2,4,5,8-

12,16,18-20), oral health knowledge (3,11,16,17), access to dental care (13,14,17), acculturation (12-14,17,19), health literacy (6,12,13,19), oral health literacy (2,3,7,8,10,15,17,18,20), and socioeconomic status of adults and children among immigrant populations (1,4,9,12,16,17,19). However, studies investigating oral health literacy in relation to childhood caries experience among U.S. Somali immigrant mother-child dyads were limited (17).

While reviewing the existing research, emerging evidence supported the potential relationship between oral health literacy and caries experience in various populations (2,7,8,10,11,15,17,18,20). Additional associations were observed in the research including, an association between the oral health literacy and the oral health status of adults and children (2,7-10,15,18,20), a relationship between health literacy, acculturation, and oral health status (12,19), and an association between oral health literacy, oral health status, and access to or utilization of dental services (13,17). Only one study had conflicting results regarding the association between parents' oral health literacy and children's oral health status (6). Brega et al. found that the relationship between Navajo parents' oral health literacy and their children's oral health status lacked statistical significance (6). Although, researchers did observe a statistically significant association between the parents' oral health literacy and their own oral health status (6). The children's oral health status was reported by the parents in a questionnaire, and 68% of parents reported their children having good to excellent oral health (6). However, the children's mean dmft score was 21.3 (6). The findings also indicated that parents who scored low on oral health knowledge also had a misunderstanding of what was considered good oral health for children, which posed as a limitation of the study (6).

In contrast to Brega et al., other studies found significant evidence that supported an association between oral health literacy or knowledge of parents and caregivers and the oral health status of children from ages 6 months to 6 years old (2,3,7,8,12,15,17,18,20). In Hong Kong, Fong et al. and Bridges et al. evaluated parental oral health literacy in relation to children's oral health status (7,8). The results were statistically significant in supporting this relationship, and the majority of children from parents with low oral health literacy were considered to have poor oral health status (7,8). Studies by Haghdoost et al. and Khodadadi et al. evaluated the relationship between parental health literacy or oral health literacy and the number of decayed, missing, or filled teeth in the children (15,20). Both studies found that low parental health literacy or oral health literacy was associated with a higher rate of dental caries and a lower number of filled teeth among children (15,20). Khodadadi et al. also found a significant relationship among children with a greater number of filled tooth surfaces and parents who lived in urban areas and scored adequately on the oral health literacy survey (15). While, Haghdoost et al. found that the probability of decayed teeth in children from illiterate mothers was 17% higher than from literate mothers (20).

Similar to Khodadadi et al., Shinn et al. conducted a study to evaluate the relationship between parents' oral health literacy, children's oral health status, and the utilization of dental services (18). Parents who scored low on oral health literacy rated the oral health of themselves and their children as poor or fair, and parents of higher oral health literacy rated the oral health of themselves and their children as good or excellent (18). Parents of higher oral health literacy were also more likely to utilize dental services, had children with a greater number of filled compared to decayed teeth, and

many were from urban communities (18). Whereas, children from parents with low oral health literacy had greater numbers of carious lesions, fewer filled teeth, and resided in rural communities (18).

In addition to parents, the influence of caregivers' oral health literacy on childhood caries experience was also suggested (2,3). Van et al. found that female caregivers with lower oral health literacy scores reported no daily brushing of children's teeth and frequently put children to bed with a bottle containing cariogenic liquid (2). Caregivers with low oral health literacy scores reported poorer oral health status of the children; while, caregivers with higher literacy scores reported better oral health status of the children (2). In Massachusetts, Finnegan et al. experienced similar results, except the study evaluated the oral health knowledge and beliefs of immigrant caregivers and the potentially deleterious effects it could have on children's dental caries risk (3). In the Finnegan study, immigrant caregivers with low literacy scores also reported putting children to bed with a bottle containing cariogenic liquids, not brushing the children's teeth daily, and did not believe that fluoride prevents tooth decay and strengthens teeth (3).

Although, immigrant populations have continued to expand in the U.S. and around the world, few studies have assessed the relationship between the oral health literacy, caries experience, and access to or utilization of dental services among immigrants or refugees (4,5,10,12,13). Studies conducted by Svensson et al., Reza et al, and Riggs et al. indicated that many immigrant participants had never been to the dentist prior to immigration due to lack of access to care, had a misconception of the importance of oral health, and lacked financial resources to pay for care (4,5,10). The researchers suggested

that the lack of utilization of dental care, caries prevention services, and oral health education among newly immigrated populations may explain the children's significantly poorer oral health status and the parents' low oral health literacy (4,5,10). Svensson et al. conducted a study on Somali children newly arrived in Sweden, and 78-82% of the children reported never visiting a dental clinic in Somalia; while, 71% of parents reported not assisting children with tooth brushing (4). Many of the participants reported using a Miswak dental cleaning tool, which is a twig from the *Salvadora persica* tree that has natural antimicrobial properties (4,22). Svensson et al. and Reza et al. found Somali or immigrant children had a substantially higher dental caries prevalence compared to resident children and presented with oral diseases in need of urgent dental care (4,5). Both studies supported the need for continued research regarding the oral health of Somali children.

Although, the number of oral health studies on Somali adults living in the U.S. were limited, several investigated the relationship between health literacy, acculturation, and the oral health status of Somali adults in the U.S. (12-14,16,17,19). A study by Geltman et al. measured Somali adults' health literacy and DMFT scores, then compared these scores to acculturation scores (12). Somali adults living in the U.S. for 0 to 4 years with lower oral health literacy had fewer decayed, missing, or filled teeth; whereas, those living in the U.S. for 5-10 years with lower oral health literacy had a greater number of decayed, missing, or filled teeth (12). Geltman et al. suspected this was due to the increased acculturation among U.S. Somali immigrants (12). Geltmen et al. also evaluated the health literacy and dental word recognition of Somali adults in relation to DMFT and level of acculturation (13). The majority of subjects scored low on health

literacy and dental word recognition, but individuals with higher levels of acculturation had higher health literacy scores (13). The average scores for decayed teeth was 1.34, missing teeth was 1.39, and filled teeth was 2.76, which is lower in comparison to DMFT scores of U.S. immigrants from other studies; however, 74% of the subjects reported brushing their teeth twice a day (13).

Like Geltman et al., Hunter-Adams et al. also conducted a study on acculturation and the potential relationship with oral health outcomes among Somali refugees in Massachusetts (19). The majority of subjects reported brushing their teeth twice a day, and less tooth decay among participants was associated with an increased understanding and speaking of English (19). The results also revealed that participants with higher acculturation and health literacy scores had fewer decayed teeth (19). A study conducted by Okenseri et al. found that Somali adults newly immigrated to the U.S. had poorer oral health status when compared to those who had lived in the U.S. for several years (16). These individuals also reported difficulties in accessing dental health services as a result of cultural, financial, and language barriers (16). The data collected in these studies provided baseline information on Somali immigrants' oral health literacy, oral health status, and acculturation status; however, they did not focus directly on the relationship between the oral health literacy and caries experience of U.S. Somali immigrant mother-child dyads living in Minnesota.

As existing research suggested, oral health attitudes, behaviors, and knowledge are acquired through education, practice, and beliefs (3,6,11,13,15). Therefore, the theoretical framework for this study was based on the Social Cognitive Theory and the Health Belief Model (6,11). The Social Cognitive Theory indicates that individuals

acquire knowledge through observing and interacting with others in various social situations (6). This theory contributes to the prediction of oral health behaviors and outcomes and mediates the relationship between health literacy and outcomes (6). The Health Belief Model attempts to explain and predict health-related behaviors (6,11). This model suggests that an individual's oral health-related attitudes and beliefs influence their oral health behaviors (6,11).

After reviewing the literature, it was evident that existing research regarding mothers' oral health literacy and children's caries experience among Somalis living in the U.S. was limited (17). Due to the lack of available research and significant findings from relevant studies, further research is warranted to investigate the oral health literacy and caries experience of Somali mother-child dyads. Results will determine the need for oral health education, promotion, and dental services in U.S. Somali-American communities. Therefore, the purpose of this study was to assess the association between the oral health literacy and caries experience among Somali mother-child dyads residing in the Minneapolis and St. Paul areas in Minnesota.

SECTION THREE

PREFACE

Objectives: Dental caries is a major oral health problem among U.S. immigrant children, and Minnesota is home to one of the largest Somali-American communities, but little is known about this population's oral health and oral health literacy. Therefore, the purpose of this study was to investigate the association between Somali mothers' oral health literacy and their children's caries experience in the Minneapolis and St. Paul areas in Minnesota.

Methods: A retrospective cross-sectional study was performed. Data were extracted from a larger cross-sectional study consisting of 99 Somali mothers and 292 children from twelve Somali-owned daycare centers in 3 Minnesota cities. Participating mothers completed an oral health literacy survey (HeLD-14), and mothers and their children received oral screenings where caries experience was recorded using the dfs/DMFS caries indices.

Results: Mean age in years was 34.3 for mothers and 6.4 for children. Mothers had moderate oral health literacy with a mean HeLD-14 score of 8.4. The children's mean dfs score was 3.3, and their mean DMFS score was 0.8. The children's caries was not associated with the mothers' total oral health literacy score, although, statistically significant associations were found between 3 of 7 HeLD-14 subcategories: access to care, receptivity, and economic barriers.

Conclusions: Somali children's caries experience was similar to U.S.-born comparatives, but lower than African-American children of similar age. Given, the children's below average caries experience and the mothers' moderate level of oral health literacy, may be

an indicator that this population does not suffer from oral health disparities related to the oral health literacy and caries experience of mother-child pairs.
Key Words: Oral health literacy; Somali; Immigrant; Oral health; Oral health status; Caries experience; Children's oral health.

MANUSCRIPT

This manuscript will be submitted to the Journal of Public Health Dentistry.

Introduction

Dental caries, or tooth decay, is the most common preventable chronic infectious disease affecting children worldwide. While, multiple factors may contribute to an individual's caries risk, oral health literacy is suggested to be a stronger predictor of oral health than age, socioeconomic status, and ethnic or racial group (3,15,21). Globally, the caries burden is higher among children of immigrants, ethnic minorities, and lower socioeconomic status, and these populations are less likely to have access to dental care (5,15,17). Although, the literature suggests parental oral health literacy could be related to children's caries experience, the number of studies investigating this relationship among mother-child dyads are limited (7,17,20).

Oral health literacy is defined as "the degree to which individuals have the capacity to obtain, process, and understand basic oral and craniofacial health information and services needed to make appropriate health decisions" (7). Caries experience is the extent to which an individual is affected by tooth decay, and is often determined by the number of decayed, missing, and filled teeth or surfaces (dmft/DMFT or dmfs/DMFS) (17,20). The dmft/dmfs indices represent primary dentition and DMFT/DMFS indices represent permanent dentition (25). Investigations between children's caries experience and mothers' health literacy found that the probability of decayed teeth in children of illiterate mothers was 17% higher than of literate mothers (7,20). Also, the majority of the children had untreated dental caries, and over 70% of parents had only up to a

secondary education, scored low on the pediatric oral health literacy questionnaire, and were of lower socioeconomic status (7). Existing research supports the relationship between oral health literacy and children's caries experience; however, few studies have evaluated this relationship among Somali immigrant populations in the United States. (17).

Over the past decade, the Somali population has been one of the fastest growing immigrant populations in Minnesota, yet little knowledge exists regarding this population's oral health (4,17,19). Furthermore, existing oral health research among Somali immigrants has revealed conflicting results (4,19). In Massachusetts, Somali adult refugees with higher oral health literacy were more likely to utilize dental services and have less untreated tooth decay (19). Whereas, in Sweden, the majority of newly arrived children were affected by oral disease and in need of urgent dental care; however, over half the parents responded incorrectly or I don't know on the oral health literacy survey (4). Even though, Somali communities are expanding in Minnesota, little knowledge exists regarding the oral health literacy and caries experience of Somali mother-child dyads (17). Therefore, the purpose of this study was to measure the association between Somali mothers' oral health literacy and their children's caries experience in the Minneapolis and St. Paul areas in Minnesota.

Methods and Materials

Study Design.

Deidentified secondary data on Somali mother-child dyads were obtained from a larger community-based participatory research study conducted by a university-

community partnership. These data were used to evaluate the association between Somali mothers' oral health literacy and their children's caries experience residing in three Minnesota metropolitan cities with large Somali populations (17). In this study, the Somali mothers' oral health literacy represented the independent variable, and the children's caries experience represented the dependent variable. The initial cross-sectional study team consisted of a university-community partnership and was conducted from 2016 to 2017 in 12 Somali-owned day care centers (17).

Subjects and Sampling Method.

Participants were initially recruited though nonprobability, convenience sampling by the Somali community co-investigator at daycare centers agreeing to participate in the study (17). The co-investigator visited the participating daycare centers prior to the screening date to explain the purpose, risks, and benefits of the study to potential Somali mother participants. The accessible population was comprised of 99 Somali mother-child groups (n=99 Somali mothers and 292 children) (17).

The inclusion criteria were Somali mother-child dyads where mothers were at least 18 years of age with children between 6 months and 12 years of age who were enrolled in the participating Somali daycare centers (17). If mothers had more than one child in this age range, then all children were allowed to participate in the study (17). Participating mothers provided consent to the survey and an oral screening for themselves and their children (17). Subjects were excluded if children aged 7 years and older did not assent to the clinical screening (17).

Mothers who consented to participate received a $25 retail store gift card, while the children were offered a free fluoride varnish application, valued at $38 (17).

Data Collection and Study Protocol.

The primary investigator of the initial cross-sectional study granted the student investigator access to the data set. Data extracted included demographic information on all participants, the Somali mothers' HeLD-14 oral health literacy scores, and the children's caries experience scores as measured by the dfs/DMFS indices (17). The dmfs/DMFS indices are standard indices used to assess and record caries experience (17,24). However, in the initial study, missing (m) surfaces in the children's primary dentition were excluded, because it could not be determined whether the missing surfaces were a result of tooth decay. In the initial study, the oral health literacy surveys were orally administered to the participating mothers by the co-investigator in the mothers preferred language (Somali or English). The minimally invasive oral screenings conducted on the children were performed by calibrated, licensed dental hygienists (17). Upon receiving approval from the University of Minnesota Institutional Review Board, the data were extracted and analyzed, which took place over a 4-month period.

Testing Instruments and Procedures.

The HeLD-14 survey consists of 14 questions representing 7 domains of oral health literacy: receptivity, understanding, support, economic barriers, access to care, communication, and utilization (23). The "receptivity" subcategory questioned the mothers' ability to pay attention to dental or oral health needs and to make time for things that are good for dental or oral health (17,23). The "understanding" subcategory questioned the mothers' ability to read written information given to them by the dentist and to read dental or oral health brochures in dental clinics or waiting rooms (17,23). The "support" category questioned the mothers' ability to take a family member or a

friend with them to a dental appointment, and the ability to ask someone to go with you to a dental appointment (17,23). The "economic barriers" subcategory questioned the mothers' ability to pay to see a dentist and to pay for medication to manage dental or oral health (17,23). The "access to care" subcategory questioned the mothers on whether they know how to get a dentist's appointment and what to do to get a dentist's appointment (17,23). The "communication" subcategory questioned the mothers' ability to look for a second opinion from a dental professional and to use advice from a dentist to make dental health decisions (17,23). The "utilization" subcategory questioned the mothers' ability to carry out dental instructions given by a dentist and to use advice from a dentist to make dental health decisions (17,23).

This survey instrument had been previously developed from the HeLD-29 health literacy survey (17,23). The HeLD-14 is a shorter version specifically developed to test oral health literacy (17,23). The HeLD-14 was initially validated in an Australian aboriginal population (17,23). The investigators from the initial cross-sectional study used the HeLD-14 instrument due to the inclusion of functional oral health literacy constructs and the similarities in the target populations as both are grounded in oral culture (17,23). Dental hygienists who performed the oral screenings were calibrated for interrater reliability to determine cavitated versus non-cavitated lesions, filled versus non-filled surfaces, and dfs/DMFS index accuracy (17).

Data Analysis.

Counts, proportions, means, and standard deviations are reported to describe the demographic characteristics of the study participants. Linear mixed effects models with random family effect and multivariable regression analyses were conducted to determine

associations between the independent variables and the dependent variables of child dfs/DMFS scores. Additional multivariant analyses were conducted to account for acculturation as a moderator. The independent variables were age of mothers and children, number of years the mothers had lived in the U.S., mothers' age at immigration, mothers' language preference, how often the mothers speak English with friends, dental insurance coverage status, child's last dental visit, child's brushing frequency, and the mothers' oral health literacy scores (HeLD-14 survey). Continuous data included the mothers' and children's age in years, number of years mothers had lived in the U.S., mothers' age at immigration, children's dfs/DMFS scores, and mothers' HeLD-14 scores. Categorical data included mothers' language preference, how often mothers speak English with friends, the mothers and child's dental insurance coverage status, child's last dental visit, and child's brushing frequency.

Additional analyses were conducted to test whether the mothers' acculturation level moderated the association between the mothers' oral health literacy and their children's caries experience. The number of years the mothers had lived in the U.S., the mothers' age at immigration, and how often the mothers speak English with friends are variables that are often used as proxies for acculturation.

For the purpose of this study, the mothers' oral health literacy or HeLD-14 scores were analyzed as a total score and as separate scores for each of the 7 sub-categories. The children's caries experience or dfs/DMFS scores were analyzed as a total score and as separate scores for decayed and filled surfaces. The dfs scores were analyzed separately from DMFS scores. These scores were used to test the null hypothesis, stating that the mothers' oral health literacy was not inversely associated with their children's

caries experience. Throughout the data analysis process, any missing data for the mother-child pairs were excluded from statistical testing. Any variables or participants with the majority or over half of the data missing were excluded from the data analysis procedures. Statistical procedures were performed using Excel and SAS analysis software version 9.3 developed at North Carolina State University in Raleigh, NC. A significance level (p-value) or alpha (a) level of 0.05 was used to determine statistical significance.

Results

The demographic characteristics for the 99 Somali mothers and the 292 children are displayed in Table 1. < insert Table 1 here >

The children's ages ranged from 6 to 12 years, and the mothers' ages ranged from 18 to 61 years. The mothers reported living in the U.S. from 1 to 24 years and over half reported living in the U.S. for 10 years or less. The mothers' ages at migration ranged from 6 years to 59 years; however, only 15 mothers reported migrating to the U.S. under the age of 18 years. The results also showed that 95 (96.85%) mothers and 277 (96.85%) children had dental insurance. Of the 292 children, 175 (60.98%) had visited a dentist within the last year, and 63 (21.95%) had visited a dentist more than one year ago, while 49 (17%) had never visited a dentist. Of those 49 children, 38 were 4 years of age or younger. There were 11 mothers that reported their children have never visited a dentist; however, all of them reported their children had dental insurance. The mothers reported 217 (76.68%) of the children brushed their teeth twice a day or more, and 50 (17.67%) of the children only brushed once a day. Whereas, 16 (5.65%) of the children were reported as never brushing their teeth.

The results for the children's caries experience are displayed in Table 2.

< insert Table 2 here >

The mothers' oral health literacy scores from the HeLD-14 survey are displayed in Table 3. < insert Table 3 here >

Based on the mothers' HeLD-14 mean total score, it was determined the mothers had moderate to high oral health literacy. The HeLD-14 total mean score had a potential range of 2.0 to 10.0 where a higher mean score indicates higher oral health literacy. Total HeLD-14 scores < 4 signified low oral health literacy, 5 to 8 signified moderate oral health literacy, and > 9 signified high oral health literacy. The oral health literacy categories were created based on the subjects in the present study.

The adjusted linear regression results that account for acculturation as a moderator are displayed in Table 4 (see Appendix A for unadjusted regression analysis results). < insert Table 4 here >

To address this study's primary research question, the results from the unadjusted and adjusted regression analyses found no statistically significant associations. Therefore, the null hypothesis was accepted. However, in the unadjusted regression analyses the mothers' responses to the "access to care" subcategory was significantly associated with the number of decayed surfaces in the children's primary dentition (p=0.0419), while the "receptivity" subcategory was significantly associated with the number of filled surfaces in the children's primary dentition (p=0.0360). A statistically significant negative association was also found between the "economic barriers" subcategory and the number of decayed surfaces in the children's permanent dentition (p=0.0280).

As expected, the unadjusted linear regression analyses found a significant positive association between child's age and the total number of decayed, missing, and filled surfaces for both primary (p=0.0430) and permanent dentition (p=0.0151). The unadjusted regression results also found a significant positive association between child's age and the number of decayed surfaces in permanent dentition (p=0.0242). Lastly, the unadjusted linear regression analyses found a statistically significant association between the Somali mothers' education groups and the number of decayed surfaces in the children's primary dentition (p=0.0499). In linear regression, the value of the coefficient for an independent variable demonstrates the size of the effect that variable has on the dependent variable. Whereas, the direction of the effect is determined by the sign of the coefficient, either positive or negative.

Discussion

The results of this study indicated that there was no statistically significant inverse association between Somali mothers' oral health literacy and their children's caries experience, which enabled the null hypothesis to be accepted. Despite these results, this study provided valuable information regarding Somali mother-child dyads in Minneapolis, St. Paul, and Rochester in Minnesota. The mean number of decayed, missing, and filled surfaces in the children's primary dentition was 3.3 surfaces, and the mean for the permanent dentition was 0.8 surfaces. These results are comparable to the U.S. national average for caries experience in children, which in primary dentition of children ages 2-11 years is 3.6 surfaces and in permanent dentition for children ages 6-11 years is 0.68 surfaces (22). However, national data does not specify the caries prevalence of Somali immigrant children residing in the U.S. The statistically significant positive

associations found between child's age and their dfs/DMFS scores were expected and supported by national data (22). Data from 2011-2012 that showed 23% of children ages 2-5 years had experienced dental caries, whereas 56% of children ages 6-8 years had experienced dental caries in primary teeth (22).

In this study, the mothers' oral health literacy total mean score on the HeLD-14 survey was 8.4 out of a maximum score of 10 points, and the majority of the mothers tested above the 50th percentile marker, which indicates moderate to high oral health literacy. Ju et al. evaluated the oral health literacy of Indigenous Australian adults using the HeLD-14 survey, and the mean scores showed that the majority of the participants had moderate to high oral health literacy (26). In contrast, Batista et al. conducted an oral health literacy study on adults in Brazil and found that 71.5% of participants had low oral health literacy (27). Of the adults with low oral health literacy, 73.2% were female and the majority were of lower middle to lower socioeconomic status (27). However, Batista el al. used an oral health literacy questionnaire developed by Ishikawa et al. in 2008, which was not a validated instrument for measuring oral health literacy (27). Existing research evaluating mothers' oral health literacy and children's caries experience among Somali populations or similar populations in the U.S. is limited, which inhibits the ability to compare this study's results to other published results (17).

There were several limitations and recommendations that should be considered for future studies. The present study's sample size was fairly small. Future studies may want to consider a larger sample size to ensure a representative distribution of the target population, and statistical relationships tend to have greater accuracy with larger sample sizes. Although, the questionnaires were orally administered by a Somali speaking

community partner, and the mothers' responses were recorded without influence from the person administering the questionnaire. Existing research supports that parents may have misconception of their children's oral health and may not know the meaning of certain oral health terms used in questionnaires, which has been shown to influence the parents' responses (4,5,10,11). In future studies, researchers may want to consider language or literacy barriers with populations that are non-English speaking or those that are of low literacy. Researchers may also want to consider using a questionnaire that is equal to the reading level of the target population. When evaluating caries experience without access to current dental radiographs, the results should be interpreted cautiously as this could underestimate the true prevalence of tooth decay in the target population. Even though, some of the results from the present study were statistically significant, the findings do not accurately represent the entire Somali population in Minnesota or the U.S., and therefore, the results cannot be generalized to Somali populations beyond those that participated in this study.

Conclusion

Ultimately, this study established that Somali mothers' overall oral health literacy was moderate to high, and their children's total dfs/DMFS scores were lower than the U.S. national average of non-white children (22). This may be an indicator that this population does not experience oral health disparities. The significant findings between the mothers' HeLD-14 subcategories and the children's dfs/DMFS scores may indicate that Somali mother-child pairs in Minnesota experience difficulties in accessing dental care, but the mothers are receptive to dental treatment when services are recommended and accessible for their children. Future research will contribute to the existing body of

oral health knowledge on Somali mother-child pairs residing in the U.S.

SECTION FOUR

TABLES

Table 1: Somali mothers and children demographic characteristics in Minnesota (mothers n=99, children n=292)

	Frequency (%)	Mean (SD)
Mothers' Age (years)	___	34.3 (6.7)
Child's Age (years)	___	6.4 (3.3)
Years in U.S. (mothers)	___	10.3 (5.8)
Mothers' Age at Immigration (years)	___	24 (7.9)
Mothers' Primary Language		
Somali	94 (95.92)	_____
English	1 (1.02)	
Other	3 (3.06)	
Speaking English with Friends (mothers)		
Never	20 (20.62)	_____
Sometimes	58 (59.79)	
Always	19 (19.59)	
Mothers' Education Groups		
Never Attended School, Primary (K-8) or Some High School	24 (24.24)	
ESL Classes	39 (39.39)	_____
High School Diploma/GED	19 (19.19)	
Some College/College/Advanced Degree	17 (17.17)	

Table 2: Somali children's caries experience reported as dfs/DMFS scores (n=292)

	Mean (SD)	Minimum / Maximum
Primary Dentition (n=267)		
Decayed Teeth Surfaces (ds)	0.8 (2.3)	0.0 / 24.0
Filled Teeth Surfaces (fs)	2.3 (6.9)	0.0 / 60.0
Decayed and Filled Surfaces (dfs)	3.3 (7.6)	0.0 / 60.0
Permanent Dentition (n=164)		
Decayed Teeth Surfaces (DS)	0.4 (1.2)	0.0 / 10.0
Filled Teeth Surfaces (FS)	0.3 (1.2)	0.0 / 10.0
Missing Teeth Surfaces (MS)	0 (0.0)	0.0 / 0.0
Decayed, Missing, and Filled Teeth Surfaces (DMFS)	0.8 (2.0)	0.0 / 12.0

Table 3: Mothers' HeLD-14 mean scores: total score and 7 subgroup scores (n=99)

	Mean (SD)	Minimum / Maximum
Total HeLD-14 Scores	8.4 (1.6)	2.0 / 10.0
HeLD-14 Subgroup Scores		
Receptivity	4.3 (1.3)	1.0 / 5.0
Understanding	3.6 (1.5)	1.0 / 5.0
Support	4.2 (1.2)	1.0 / 5.0
Economic Barriers	3.6 (1.7)	1.0 / 5.0
Access to Care	4.3 (1.2)	1.0 / 5.0
Communication	4.6 (0.8)	1.0 / 5.0
Utilization	4.8 (0.6)	1.0 / 5.0

Table 4: Adjusted Linear Regression Results with Acculturation as Moderator

Outcome: Child dfs	**Coefficient**	**Standard Error**	**p-Value**
Variable:			
Acculturation Sum	-0.20	1.23	0.8706
HeLD-14 Mean	-0.62	2.47	0.8042
HeLD-14 Mean / Acculturation Sum Interaction	0.03	0.15	0.8189
Outcome: Child DMFS	**Coefficient**	**Standard Error**	**p-Value**
Variable:			
Acculturation Sum	-0.13	0.34	0.7032
HeLD-14 Mean	-0.30	0.70	0.6665
HeLD-14 Mean / Acculturation Sum Interaction	0.02	0.04	0.6738

SECTION FIVE

PRACTICAL APPLICATION

Given the higher oral health literacy of Somali mothers in Minnesota and the lower dental caries prevalence among their children, this may be an indicator that oral health education and promotion programs may not be needed in this population as compared to other populations with greater oral health disparities. Further knowledge regarding the strengths of the Somali culture could assist in understanding this populations ability to maintain good oral health, despite the stresses associated with migration. It could be beneficial to have oral health advocates within Somali-American communities who could assist this population with access to care and the translation or interpretation of oral health information.

Dental professionals in the U.S., especially those serving Somali-American communities, could benefit from a basic understanding of the Somali culture, including existing oral health, common oral health care practices, and basic oral health beliefs. As a result, dental professionals would have a better understanding of how to effectively serve this population. This could be accomplished through continuing education courses in dentistry, as well as, incorporating this information into the curricula at dental education institutions. For example, dental or dental hygiene programs could include a segment on Somali culture in a multi-cultural course or an equivalent course.

This study supports higher oral health literacy and lower caries rate among Somali mother-child pairs residing in Minnesota; however, existing oral health information regarding this population is limited (17). Further research is required to contribute to the existing body of knowledge, and to determine whether there is a need for oral health education and promotion programs in other Somali-American communities in the U.S. In

future studies, researchers may want to consider potential language or literacy barriers with Somali-American populations that are non-English speaking, parents' misconception of their children's oral health, and using a questionnaire that has a similar reading level to the target population.

SECTION SIX

BIBLIOGRAPHY

1. Baggio S, Abarca M, Bodenmann P, Gehri M, Madrid C. Early Childhood Caries in Switzerland: A Marker of Social Inequalities. BMC Oral Health. 2015 Jul 22;15(82).

2. Vann WF, Lee JY, Baker D, Divaris K. Oral Health Literacy Among Female Caregivers: Impact on Oral Health Outcomes in Early Childhood. J Dent Res. 2010;89(12): 1395-1400.

3. Finnegan DA, Rainchuso L, Jenkins S, Kierce E, Rothman A. Immigrant Caregiver's of Young Children: Oral Health Beliefs, Attitudes, and Early Childhood Caries Knowledge. J Community Health. 2016 Apr;41(2): 250-257.

4. Svensson I, Gustafsson J, Uleskog E, Mathisson C, Molla N, Kahlmeter A, Matsson L. Oral Condition and Background Factors in Somali Immagrant Children Newly Arrived in Sweden. Swed Dent J. 2016;40(2): 153-164.

5. Reza M, Amin M, Sgro A, Abdelaziz A, Ito D, Main P, Azarpazhoon A. Oral Health Status of Immigrant and Refugee Children in North America: A Scoping Review. J Can Dent Assoc. 2016;82: g3.

6. Brega AG, Thomas JF, Henderson WG, Batliner TS, Quissell DO, Braun PA, Wilson A, Bryant LL, Nadeau KJ, Albino J. Association of Parental Health Literacy with Oral Health of Navajo Nation Preschoolers. Health Edu Res. 2016 Feb;31(1): 70-81.

7. Fong Lai SH, Wong MK, Wong HM, Yiu CK. Parental Oral Health Literacy of Children with Severe Early Childhood Caries in Hong Kong. European J Pediatric Dent. 2017;18(4): 326-331.

8. Bridges SM, Parthasarathy DS, Wong HM, Yiu CK, AU TK, Mcgrath CP. The Relationship Between Caregiver Functional Oral Health Literacy and Child Oral Health Status. Patient Educ Couns. 2014;94: 411-416.

9. Khani-Varzegani F, Erfanparast L, Asghari-Jafarabadi M, Shokravi M, Azabdaftari F, Parto M, Shokrvash B. Early Occurrence of Childhood Dental Caries Among Low Literate Families. BMC Res Notes. 2017;10: 366.

10. Riggs E, Gibbs L, Kilpatrick N, van Gemert C, Ali S, Waters E. Breaking Down the Barriers: A Qualitative Study to Understand Child Oral Health in Refugee and Migrant Communities in Australia. Ethinicity and Health. 2015;20(3): 241-257.

11. Albino J, Tiwari T, Henderson WG, Thomas JF, Braun PA Batliner TS. Parental Psychosocial Factors and Childhood Caries Prevention: Data from an American Indian Population. Community Dent Oral Epidemiol. 2018: 1-9.

12. Geltman PL, Hunter-Adams J, Cochran J, et al. The Impact of Functional Health Literacy and Acculturation on the Oral Health Status of Somali Refugees Living in Massachusetts. Amer J of Pub Health. 2013: e1-e8.

13. Geltman PL, Hunter-Adams J, Penrose KL, et al. Health Literacy, Acculturation, and The Use of Preventive Oral Health Care by Somali Refugees Living in Massachusetts. J of Immigrant and Minority Health. 2014;16: 622-30.

14. Adams JH, Young S, Laird LD, Geltman PL, Cochran JJ, Hassan A, Egal F, Passche-Orlow MK, Barnes LL. The Cultural Basis for Oral Health Practices Among Somali Refugees Pre- and Post-Resettlement in Massachusetts. J Health Care Poor Underserved. 2013 Nov;24(4): 1474-1485.

15. Khodadadi E, Niknahad A, Sistani MMN, Motallebnejad M. Parents' Oral Health Literacy and Its Impact on Their Children's Dental Health Status. Electronic Physician; 2016 Dec;8(12): 3421-3425.

16. Okenseri C, Hodges JS, Born DO. Self-Reported Oral Health Perceptions of Somali Adults in Minnesota: A Pilot Study. Int J Dent Hygiene. 2008;6: 114-118.

17. Flynn P, Chang V, Lunos S. Intergenerational Caries Among Mother-Child Pairs Following Migration. Pediatric Dental Care. 2016; In Press.

18. Shinn WK, Braun TM, Inglehart MR, Habil P. Parents' Dental Anxiety and Oral Health Literacy: Effects on Parent's and Children's Oral Health-Related Experiences. J Pub Health Dent. 2014;74(3): 195-201.

19. Hunter-Adams J, Cochran J, Laird LD, Paasche-Orlow MK, Geltman PL. Acculturation and a Potential Relationship with Oral Health Outcomes Among Somali Refugees in Massachusetts. J Immigr Minor Health. 2017 Aug 31. DOI: 10.1007/s10903-017-0650-0.

20. Haghdoost AA, Hessari H, Baneshi MR, Rad M, Shahravan A. The Impact of Mother's Literacy on Child Dental Caries: Individual Data or Aggregate Data Analysis? J Educ Health Promot. 2017 Apr 19;6(5).

21. Podschun, GD. National Plan to Improve Health Literacy in Dentistry. J Calif Dent Assoc. 2012 Apr;40(4): 317-20.

22. U.S. Department of Health and Human Services [Internet]. Washington, DC: Office of Disease Prevention and Health Promotion. Healthy People: Oral Health; c2014 [updated 2019 Feb 15]. Available from: https://www.healthypeople.gov/2020/topics-objectives/topic/oral-health

23. Laird LD, Barnes LL, Hunter-Adams J, Cochran J, Geltman PL. Looking Islam in the Teeth: The Social Life of a Somali Toothbrush. Med Anthropol Q. 2015 Sep;29(3): 334-356.

24. Jones K, Brennan D, Parker E, Jamieson L. Development of a Short-Form Health Literacy Dental Scale (HeLD-14). Com Dent and Oral Epidem. 2015 Apr;43(2): 143-151.

25. Anaise JZ. Measurement of Dental Caries Experience-Modification of the DMFT Index. Comm Dent and Oral Epid. 1984 Feb;12(1): 43-46.

26. Ju X, Brennan D, Parker E, Mills H, Kapellas K, Jamieson L. Efficacy of an Oral Health Literacy Intervention Among Indigenous Australian Adults. Comm Dent and Oral Epid. 2017;45: 413-26.

27. Batista MJ, Lawrence HP, Sousa MR. Oral Health Literacy and Oral Health Outcomes in an Adult Population in Brazil. BMC Pub Health. 2018;18: 60.

SECTION SEVEN

APPENDICES

APPENDIX A: IRB Approval Form

STUDY00003345 has been approved

Inbox x

ethosirb@umn.edu

Apr 27 (2 days ago)

to me

Template:IRB_T_Post-Review_Approved

Notification of Approval

To:	Kylee Zeyer
Link:	STUDY00003345
P.I.:	Priscilla Flynn
Title:	Oral Health Literacy and Caries Experience of Somali Mother-Child Pairs
Description:	This submission has been approved. You can access the correspondence letter using the following link: Correspondence_for_STUDY00003345.pdf(0.01) To review additional details, click the link above to access the project workspace.

APPENDIX B: Unadjusted Linear Regression Results

Variable	**Outcome** Coefficient (Standard Error)/ p-value		
	dfs	**ds**	**fs**
HeLD-14 Mean	0.0(0.36)/ 0.9994	-0.18(0.10)/ 0.0590	0.21(0.31)/ 0.4831
Receptivity Mean	0.81(0.45)/ 0.0723	-0.08(0.13)/ 0.5472	0.80(0.38)/ 0.0360
Understanding Mean	-0.20(0.37)/ 0.5857	-0.19(0.10)/ 0.0635	0.06(0.31)/ 0.8535
Support Mean	0.53(0.44)/ 0.2293	-0.06(0.12)/ 0.5877	0.50(0.37)/ 0.1806
Economic Barriers Mean	-0.47(0.31)/ 0.1344	-0.09(0.08)/ 0.2923	-0.28(0.26)/ 0.2966
Access Mean	0.02(0.47)/ 0.9689	-0.25(0.12)/ 0.0419	0.31(0.39)/ 0.4305
Communication Mean	0.64(0.70)/ 0.3584	-0.19(0.19)/ 0.3039	0.87(0.58)/ 0.1397
Utilization Mean	-0.32(0.92)/ 0.7269	-0.35(0.25)/ 0.1690	-0.13(0.79)/ 0.8657
Child Age	0.31(0.15)/ 0.0430	0.08(0.05)/ 0.0760	0.22(0.14)/ 0.1166
Mother Age	-0.06(0.08)/ 0.4873	0.03(0.02)/ 0.2405	-0.08(0.07)/ 0.2869
Years in US	-0.09(0.09)/ 0.3374	-0.02(0.03)/ 0.4195	-0.05(0.08)/ 0.5245
Age at Migration	0.0(0.07)/ 0.9597	0.03(0.02)/ 0.1113	-0.03(0.06)/ 0.6197

Variable	**Outcome** Coefficient (Standard Error)/ p-value		
	DMFS	**DS**	**FS**
HeLD-14 Mean	0.00(0.10)/ 0.9669	-0.01(0.06)/ 0.8736	-0.02(0.06)/ 0.7457
Receptivity Mean	0.09(0.16)/ 0.5869	0.07(0.10)/ 0.4402	-0.06(0.09)/ 0.5386
Understanding Mean	-0.04(0.10)/ 0.7014	0.03(0.06)/ 0.6524	-0.10(0.06)/ 0.0959
Support Mean	0.14(0.12)/ 0.2602	0.07(0.07)/ 0.3693	0.0(0.07)/ 0.9952
Economic Barriers Mean	-0.11(0.09)/ 0.2068	-0.12(0.05)/ 0.0280	0.04(0.05)/ 0.4294
Access Mean	0.01(0.13)/ 0.9217	-0.02(0.08)/ 0.8357	0.01(0.08)/ 0.8685
Communication Mean	-0.07(0.19)/ 0.7167	0.01(0.12)/ 0.9067	-0.06(0.11)/ 0.5923
Utilization Mean	0.13(0.25)/ 0.6014	0.03(0.15)/ 0.8179	0.01(0.15)/ 0.9568
Child Age	0.18(0.07)/ 0.0151	0.10(0.04)/ 0.0242	0.03(0.05)/ 0.5640
Mother Age	-0.01(0.02)/ 0.8268	0.0(0.01)/ 0.8522	0.01(0.01)/ 0.6027
Years in US	-0.04(0.02)/ 0.0959	-0.02(0.02)/ 0.1163	0.0(0.01)/ 0.8787
Age at Migration	0.02(0.02)/ 0.3107	0.01(0.01)/ 0.3119	0.01(0.01)/ 0.6099
Child Insurance	0.79(0.91)/ 0.3876	0.36(0.52)/ 0.4872	0.28(0.55)/ 0.6096